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G. R. BEEBE ET AL

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THREAD

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FIG. 1.

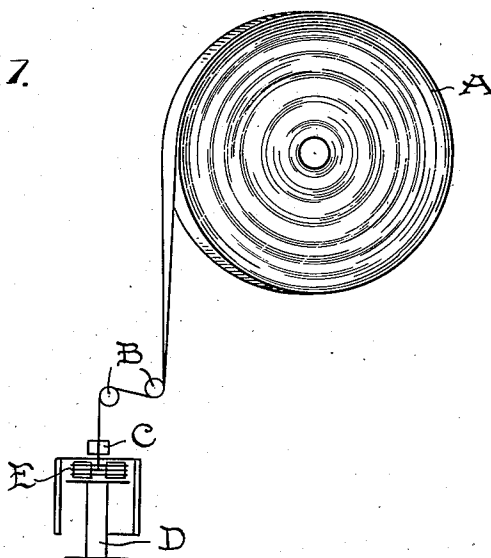


FIG. 2.

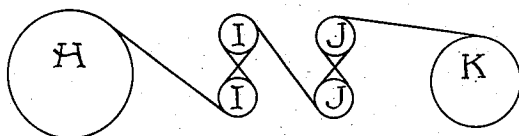
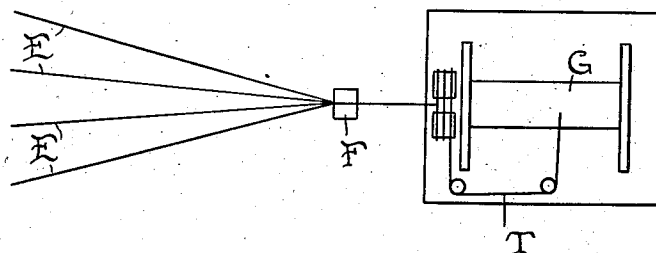


FIG. 3.

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THREAD

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6 Claims. (Cl. 57—140)

This invention relates to improved thread.

It is usual for threads and other filaments, useful for tensile purposes, to be spun or otherwise formed from substances stable in the presence of water and, to this end, every effort is made to improve their resistance to water, so that they will retain their utility even when immersed or otherwise exposed to water. However, it appears that special applications occur where the contrary is true and the whole lore and attitude of the textile and cordage industry toward water become pointless. For example, it is highly desirable that paper bags be closed by thread which is dispersible in water and in materials used in paper pulp beaters. For instance, where the bag is used for packaging sugar and its closure is in the form of a cotton thread, great care has to be exercised in preventing particles of the thread falling in the mixture in which the sugar is used. Oftentimes, while emptying the sugar from the bag into the mixture, particles of the thread drop into the mixture and, as the cotton will not disperse, additional straining operations are required for removing those particles before the mixture can be used. If the contents of the paper bag are to be used in the manufacture of paper, the bag with its contents can be placed bodily in the paper pulp stock if the closure means are dispersible in the stock, but not if a cotton thread has been used for closing the bag. Also, if discarded paper bags are to be reclaimed for subsequent manufacture of paper, their value is greatly depreciated if they have a cotton thread closure. Paper bags sewn with cotton thread have a comparatively small reclaim value, this figure running from eight to fifteen dollars a ton, due to the necessity of using manual labor in removing the insoluble cotton sewing thread, as the latter must be removed before the reclaimed bag can be deposited in the paper pulp stock. Resort has been had to closing paper bags by pasting, but this is not commercially feasible, at least in certain types of bags, because such closure means is too insecure for a large number of uses which require the safety and extra strength of sewing. It has also been proposed to use a sewing thread made of paper, but this, also, is not entirely satisfactory for reasons hereinafter set forth.

One object of the present invention is to overcome the above difficulties by providing a sewing thread for closing paper bags which, together with the bag, will be dispersed, or, if desired, actually dissolved in water or in material used in

paper pulp stocks in the paper-making industry under the action of a beater roll.

Another object is to provide a paper bag sewing thread which is not only dispersible under the conditions just stated, but which is also strong enough to permit its being used in commercial machines now in use for sewing paper bags with cotton thread.

The present invention contemplates a thread made of a polyvinyl alcohol which is dispersible in water. Various types of this material are available and, hence, the invention is not limited to any one particular type, except that it must be capable of being rather readily dispersed in water. In the preferred embodiment of the invention, one or more ends or lengths of polyvinyl alcohol are used in the thread and the ends or threads subjected to a controlled stretching operation, as this increases the tensile strength of the ends and thread formed therefrom.

In the accompanying drawing,

Figure 1 is a diagrammatical illustration of mechanism for twisting an end or thread;

Fig. 2 is a similar illustration of a plying apparatus; and

Fig. 3 is a similar illustration of mechanism for stretching the ends or threads.

In the preferred embodiment of the invention, the polyvinyl alcohol is produced in film-like strips which are individually twisted into ends and the finished thread is formed of one or more of these ends. The size of the end will, of course, depend upon the thickness and width of the strip from which the end is formed and the number of ends used in forming the thread will, in turn, depend upon the size of the ends and the size desired for the finished thread. If a comparatively fine thread is desired, it is possible to make the end large enough so that a single end may serve as the thread. Where a large thread is desired, a number of ends can be plied or twisted together. The twisting of the film-like strip can be accomplished while the strip is dry or with the use of steam or a suitable spinning solution on any known type of twisting frame such as used for twisting paper. The number of turns of twist may be varied between rather wide limits and the twisting may be done with or without a tubing device. The several ends can be plied on usual twisting equipment used in the textile industry. The spinning or twisting can be accomplished while the material is dry or with the use of steam or other heat or moisture source. Suitable spinning solutions, such as starch, various sugars, glycerol can be used.

In lieu of twisting the film-like strips to form the ends, the polyvinyl alcohol can be extruded in the form of continuous filaments, one or more of which can be used in producing the finished thread, as before described.

It has been found that the thread can be strengthened considerably by stretching either before or after the ends are plied. The particular point in the production of the thread at which the stretching is applied, is immaterial. A multiple-ply product can be stretched either by stretching the individual ends before plying, or stretching them as a group after plying. However, as the submolecular structure of the present material is such that a single filament can be stretched and its tensile strength thereby increased to a point where it alone can serve as the thread, the necessity of plying is eliminated. It is also possible to stretch the material in film-form or before the twisting operation.

The present thread is of ample strength for the purpose for which it is intended and its principal virtue is its dispersibility in water and materials used in ordinary paper pulp stocks under the action of a beater roll. Due to this feature, use of the present thread in paper bags has more than trebled the reclaim value of the bags, paper manufacturers being willing to pay a minimum price of thirty to thirty-five dollars a ton for paper bags closed with the present thread, as compared with the minimum of approximately ten dollars a ton paid for the bags sewn with cotton thread. The bags, with the present thread, can be placed directly in with the ordinary paper pulp stock or, in the case of sugar packaged in the bags, it is not necessary, in emptying the bag, to exercise any great amount of care to prevent particles of the thread falling in the mixture. In fact, where the presence of the bag is not detrimental, as in using the bag or its contents in paper pulp stock, the bag and its contents can simply be deposited in the batch of stock, as the present closure thread will disperse.

As previously indicated, various types of polyvinyl alcohol are available, but, in practicing the present invention, care must be taken to select only those types which are water-dispersible. In some instances, it might be desirable to use a type which will actually dissolve in water, but the primary characteristic is that the particular type used must be capable of ready disintegration for regeneration purposes.

Aside from the property of dispersibility or solubility, the polyvinyl alcohols possess other marked advantages over such a material as paper. Where paper is to be spun into thread, care must be had to select a paper having a high degree of spinnability. Such a paper is difficult to produce because of the tendency of the natural fibers to become arranged promiscuously or at random in the sheet, whereas, the best results, so far as concerns spinning, are obtained where the fibers are arranged substantially unidirectional lengthwise of the paper. Such an arrangement, however, is quite difficult to produce on a commercial basis, thus materially increasing production costs. On the other hand, the polyvinyl alcohols have no structural element comparable to the natural fibers used in the manufacture of paper. Consequently, the materials proposed in the present instance possess the desired degree of spinnability. Again, a thread of polyvinyl alcohol is considerably stronger than a thread of like size made of twisted paper. This is espe-

cially true where the polyvinyl alcohol thread has been stretched as previously described. Thus, the present material is much to be preferred over paper because a smaller thread can be used and, naturally, the smaller thread will possess greater flexibility which is a further feature that is quite advantageous in using the thread in present day high speed sewing machines. In connection with the comparative strength of the present thread and paper thread, it should also be pointed out that sizing or calendering of the paper, which tends to strengthen it, is impossible, because those operations would seriously interfere with the dispersibility of the paper thread.

While the present thread has been developed primarily for use in closing paper bags, it will, no doubt, be susceptible of other uses. It will also be understood that, while reference has been made to the action of the beater roll in dispersing the present thread, such action of the roll is not indispensable. The present thread will become dispersed in water without the use of the beater roll, the latter being used only to expedite or facilitate the dispersion of the thread.

The steps of twisting, plying and stretching the thread, or the ends composing the same, are shown diagrammatically in the accompanying drawing. Fig. 1 illustrates a roll or coil A of the material in strip form and the strip is drawn over tensioning rods B, B, through a tube C on to a revolving flyer or bobbin D which twists the strip into an end E. Where a number of ends are used to form the thread, they are drawn through a tube F on to a revolving flyer or bobbin G which twists them together into the thread T. For stretching the thread or end, it is drawn from a bobbin H around capstans I, J, revolving at different speeds on to a bobbin K. The capstans J revolve at a speed higher than that of the capstans I to stretch the end or thread. As previously described, the ends may be stretched before the plying step or the thread itself may be stretched.

What we claim is:

1. A paper bag closure composed of a thread made essentially of polyvinyl alcohol extending through the wall of the bag, said thread being capable of being applied to the paper bag by sewing for closing said bag, and said thread and bag both being dispersible in water under the action of a beater roll for regeneration purposes.

2. A paper bag closure composed of a thread extending through the wall of the bag, said thread consisting of one or more ends each formed of a twisted film-like strip of a polyvinyl alcohol, said thread being capable of being sewn into the bag for closing the latter and said thread and bag both being dispersible in water under the action of a beater roll for regeneration purposes.

3. A paper bag closure formed of a thread extending through the wall of the bag and capable of being incorporated in said bag by sewing for closing the latter, said thread being formed of one or more extruded ends of polyvinyl alcohol, and said thread and bag both being dispersible in water under the action of a beater roll for regeneration purposes.

4. A paper bag closure formed of a thread composed of one or more ends of polyvinyl alcohol extending through the wall of the bag, said thread being stretched to orient the polymer and capable of being incorporated in the bag for sewing to close the bag, said thread and bag both being dispersible in water under the action of a beater roll for regenerating purposes.

5. A paper bag closure formed of a thread extending through the wall of said bag and composed of one or more ends of polyvinyl alcohol stretched to increase its tensile strength, said thread being capable of being sewn into the bag to close the latter, and said thread and bag both being dispersible in water under the action of a beater roll for regeneration purposes.

6. A paper bag closure formed of a thread extending through the wall of said bag and com- 10

posed of one or more ends each made of a twisted film-like strip of polyvinyl alcohol stretched to orient the polymer before being twisted, said thread being capable of being applied to the bag by sewing to close the latter, and said thread together with the bag being dispersible in water under the action of a beater roll for regenerating purposes.

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